

EXPERIMENT -6

COLPITT'S OSCILLATOR

AIM: To design a Colpitt's Oscillator with following specifications and to verify the phase shift (180°) and find the frequency of oscillations.

DESIGN SPECIFICATIONS:

$V_{cc} = 12V$, $R_1 = 18.3k$, $R_2 = 6.8k$, $R_e = 1k$, $R_c = 2.2k$, $C_1 = C_2 = 1\mu F$, $L = 1mH$, NPN transistor with β value 100.

APPARATUS:

- CRO
- Regulated DC power supply
- Decade resistance Box
- Decade capacitance Box
- Decade inductance Box
- Resistors
- Capacitors
- Transistor
- Bread board, Single strand wires

SOFTWARE SIMULATION:

Software used: Multisim Analog Devices Edition 14.0

Procedure:

1. Switch ON the computer and open the Multisim software
2. Observe Design tool box, Instrumentation tool box, component tool box and its component functionality
3. From above tool boxes, Connect the circuit using the designed values of each and every component
4. Connect the output of amplifier to input of β -network[LC Combination] and output of β -network to input of amplifier.
5. Connect the Cathode Ray Oscilloscope (CRO) to the input and output terminals of the circuit.
6. Go to simulation button click it for simulation process.
7. From the CRO observe the following values:
 - Frequency of Oscillations
 - Phase Shift = 180°

The diagram shows a CE Amplifier Circuit. The input signal V_{in} is coupled to the base of the transistor Q5 through a capacitor C_b (10 μ F). The base is biased by a voltage divider consisting of resistors R_{11} (20 k Ω) and R_{12} (7 k Ω) connected to a 12.0V V_{CC} supply. The emitter is connected to ground through a resistor R_e (1 k Ω) and a large bypass capacitor C_e (100 μ F). The collector is connected to V_{CC} through a resistor R_c (2.2 k Ω) and has a coupling capacitor C_c (10 μ F) leading to the output V_{out} . A feedback network, labeled β -network, is connected from the output V_{out} back to the input V_{in} through a series combination of capacitors C_1 (1 μ F) and C_2 (1 μ F), and an inductor L_1 (1 mH). A small inset at the top shows a waveform on a scope, labeled 'Ext Trig'.

The screenshot shows the Oscilloscope-XSC5 software interface. The main display area shows two sine waves, Channel A (red) and Channel B (blue), plotted on a grid. The text "Phase Shift is 180°" is displayed in the center of the plot area. The bottom control panel includes settings for Timebase, Channel A, Channel B, and Trigger. The Timebase is set to 100 us/Div. Channel A is set to 5 V/Div, and Channel B is set to 5 V/Div. The Trigger is set to Normal. The X and Y positions are set to 0. The Y-axis ranges are set to AC, 0, and DC. The Trigger level is set to 0. The Trigger source is set to A. The Trigger mode is set to None.

Parameter	Value
Time	9.049 ms
Channel_A	-1.972 V
Channel_B	2.065 V
T2-T1	0.000 s
Channel_A	0.000 V
Channel_B	0.000 V

Timebase: 100 us/Div

Channel A: 5 V/Div

Channel B: 5 V/Div

Trigger: Normal

Edge: A

Level: 0

Y/T: Add B/A A/B

AC 0 DC

AC 0 DC -

Single Normal Auto None

Ext. trigger ☐

From the above waveform we can conclude that the phase shift b/w input and output signal is 180° .

HARDWARE SIMULATION:

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Apply the supply voltage , $V_{cc}=12V$
3. Make sure that the transistor is operating point in active region by keeping V_{CE} half of V_{CC} .
4. Now note down the frequency of oscillations generated for different inductance values.
5. Now calculate the theoretical frequency of oscillations generated.

Observations:

Colpitt's Oscillator

Inductance(H)	Frequency(Hz)

Conclusion: